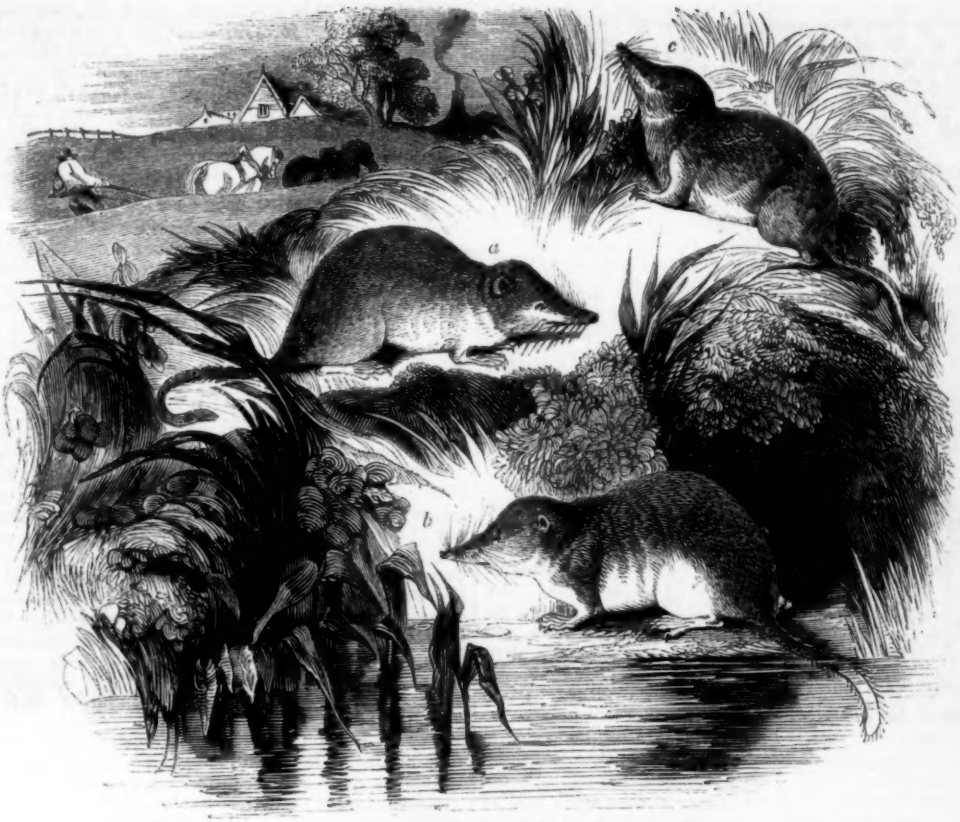


[a, Oared Shrew—Sorex remifer. b, Water-Shrew—Sorex fodiens. c, Common Shrew—Sorex araneus.]

BRITISH SHREWS.

By many persons these singular little animals are looked upon as "kinds of mice;" they see them mouse-like in size and general aspect, and common as our true mice, not having a definite idea of their real characteristics, and therefore, using the term *mouse* very indefinitely, they call these Shrews *mice*, when in truth there is no affinity between them. Mice belong to the rodent order, viz. that including the squirrel, the hare, the rabbit, the guinea-pig, the porcupine, and the beaver. The Shrews, on the contrary, belong to the insectivorous order, that order which comprehends the hedgehog and the mole. The dentition, which is eminently in accordance with the appetite of these animals, consists of two incisors in each jaw: the upper ones are curved and notched at the base; the lower ones are elongated and almost horizontal, the upper edge being in some species serrated. These are followed on each side by three, four, or five false molars above, and two below. The true molars are four on each side above, and three below. Their surface is acutely tuberculated. Some naturalists regard the false molars as lateral incisors.

The shrews are little plantigrade animals, covered by close, short, soft, and silky fur; the ears are small; the snout singularly elongated, tapering to a point, and moveable, and furnished with long whiskers; the eyes are very small; the tail is rather long, and in many species, when adult, quadrangular, as in the Common Shrew of our island. Along the sides are situated small glandular orifices, whence exudes, at particular seasons of the year, a strong musky humour, rendering their flesh unpalatable to the cat, which kills and leaves them. These orifices are surrounded by stiff close hairs. In certain foreign shrews, as the Sorex Indicus, the odour is exceedingly powerful. The Common Shrew, Sorex araneus of Bell and most British writers, is not the S. araneus of continental naturalists, but the Sorex tetragonurus. This is the opinion of Mr. Jenyns, and it agrees with our own personal observations of an extensive series of specimens in the Paris Museum.

This little animal is very common, but very timid and shy; it frequents sunny banks covered with grass and other vegetation, brakes and copses, and its feeble chirring cry may be often heard, the animal remaining concealed. We may here observe that we have known persons whose ears were incapable of catching this shrill and very peculiar note; their auditory nerves seemed to be insensible of it, or the tympanum of the ear failed to receive or respond to the atmospheric vibration.

The shrew feeds upon insects and their larvæ, together with worms, and in quest of which it grubs with its long flexible snout in the earth, using it both as a borer and a feeler. According to Pennant, the shrew inhabits old walls, heaps of stones, hayricks, manure beds; it also tenants holes in the ground, and burrows in banks and among the roots of trees. The female breeds in the spring, producing from five to seven young ones at a birth; for these she prepares a snug nest of grass and soft dry herbage, artfully concealed in any hole or fissure her instinct may lead her to select, generally in a tufted bank or among tangled vegetation. The nest, which is covered over at the top,

has an orifice at the side for her entrance and exit. Like all the smaller animals, which rapidly multiply their species and bring forth a numerous progeny, the shrew has many enemies, and though the cat will not eat it, hawks and owls are by no means so fastidious, and numbers fall a prey to these rapacious birds, to weasels, stoats, and even the mole: besides, as we have often observed, there seems to be, from some unexplained cause, a periodical mortality among these animals; this occurs in August or the beginning of September, at which season numbers are found dead in fields and along road sides, without exhibiting any external injury, at least in many instances; in several cases, however, which have come under our own notice, the animal appeared to have been killed, though the skin was not lacerated. All the insectivora are impatient of hunger, requiring a continual supply of food; they die under a short fast. This constitutional peculiarity is exemplified in the mole, and equally so in the shrew. This voracity is accompanied by great pugnacity of disposition, which leads them to attack each other, the weaker usually falling a victim to his stronger adversary. Mr. Bell says that if two shrews be placed together in a box, a very short time only elapses before they commence fighting, the victor not only killing, but feasting on the vanquished. This ferocity is exhibited also by the mole, but not, as far as we are aware, by the hedgehog. Like the latter animal, the shrew was formerly an object of popular superstition. Even Aristotle declares its bite to be dangerous to horses and other beasts of burden, and more especially so if the shrew be a female with young, boils ensuing, which, if the bite be given by the female in question, break into ulcers. Pliny affirms that in Italy the bite of the shrew is poisonous. Agricola continues the story, stating that the shrew is called *mus araneus* by the Latins, because it injects venom from its bite like a spider (*Aranea*). He describes the form of the animal's incisor teeth and of the wound they make. In warm climates, he says, the bite is generally pestiferous, but not so in cold climates; and he recommends as a remedy that the animal be cut asunder and applied to the wound. Cuvier observes that in France "it is accused of causing a malady in horses by its bite—a false imputation;" and it would appear that a small tumour in the thigh of the horse, often accompanied by severe symptoms, is called musaraigne or musette, the French names of the shrew. In our own country the bite of a shrew was (and in some districts is still) believed to be venomous to cattle, nay, that it paralyzed or produced dreadful pain by merely running over an animal's foot. Bingley says, "When a horse in the fields happened to be suddenly seized with anything like a numbness in his legs, he was immediately judged by the old persons to be planet-struck or shrew-struck. The mode of cure which they prescribed, and which they considered in all cases as infallible, was to drag the animal through a piece of bramble that grew at both ends." This, however, was not the only mode of cure. White, in his 'History of Selborne,' says, "At the south corner of the Plestor,* or area near the church, there stood, about twenty years ago, a very old grotesque hollow pollard ash, which for ages had been looked upon with no small veneration as a shrew-ash. Now a shrew-ash is an ash whose twigs or branches, when gently applied to the limbs of cattle, will immediately relieve the pains which the beast suffers from the ruming of a shrew-mouse over the part; for it is supposed that a shrew-mouse is of so baneful and deleterious a nature, that wherever it creeps over a beast, be it horse, cow, or sheep, the suffering animal is afflicted with cruel anguish, and threatened with the loss of the use of the limb. Against this accident, to which they were continually liable, our forefathers always kept a shrew-ash at hand, which, when once medicated, would keep its virtue for ever. A shrew-ash was made thus:—Into the body of the tree a deep hole was bored with an auger, and a poor devoted shrew-mouse was thrust in alive and plugged in, no doubt with several quaint incantations long since forgotten." This shrew-ash on the Plestor was destroyed by orders of the clergyman.

"The late vicar stubb'd and burnt it,"

when he was way-warden, regardless of the remonstrances of the bystanders, who interceded in vain for its preservation, urging its power and efficacy, and alleging that it had been—

"Religione patrum multos servata per annos."

The Common Shrew measures about two inches and three-quarters in the length of the head and body, that of the tail being one inch ten lines. The colour is reddish-brown above, greyish beneath: the tints vary in intensity in different individuals. The Water-Shrew is a distinct species from the Common Shrew, differing in habits and manners. This species is the *Sorex bicolor* of Shaw, the *Sorex fodiens* of English naturalists; but, as Mr. Jenyns asserts, not of Duvernay nor of continental writers generally.

It is but recently that naturalists have ascertained the existence of the Water Shrew in our island; yet in certain districts it is by no means uncommon, and in some places was popularly considered to be a small sort of mole, from its velvety fur, its burrowing habits, its pointed snout, and its minute eyes and ears. Though often found at some distance from the water, this little animal may be regarded as aquatic in its habits, and is well formed for swimming; the hind-feet are broad, and the sides of the toes are furnished with rows of fine bristles, each row constituting a sort of vane, serving the purpose of a web. A fringe of long hairs runs along the under surface of the tail, rendering it more effective as a rudder. The Water-Shrew swims and dives in pursuit of its prey with admirable ease and address; but it is so shy, and its hearing is so acute, that it is not to be observed without some precaution. The first detailed account of the manners of this animal from personal observation was by Mr. Dovaston, and published in Loudon's 'Magazine,' vol. ii., p. 219. He notices that it swims rather superficially with the belly flattened, the sides, as it were, spread out, and the tail extended as a rudder. The motion of the hinder feet is alternate, but it makes its way with great velocity, and dives instantaneously; its black velvety coat becoming beautifully silvered by the innumerable bubbles of air that cover it when submerged.

These shrews live for the most part "in the banks of rivulets and spring-water ditches, and appear to collect their food, which probably consists of the larvæ of the ephemeral flies, from among the loose mud. If cautiously watched, they may be seen crouching at the mouths of their holes, looking intently on the water. Should a shoal of minnows or stickle-backs pass near, the shrew plunges amongst them, but seldom succeeds in making a capture; and, retiring to his station, looks out for another chance. When pursued by the weasel, they drop into the water, and pass to the other side." These Water-Shrews are evidently gregarious in their habits, and are very lively and sportive; they feed on aquatic insects, and on such as are accidentally drowned; they root amidst the leaves and mud with their long noses, in search of food, with great earnestness and perseverance, or pursue their insect prey in the water, as the otter gives chace to fish, and with the same determination. They dwell in extensive shallow burrows, excavated in the bank sides. The female breeds in spring, producing from five to seven young

* Or Pleystow—locus ludorum—a play-place.

at a birth. Their note is a short, shrill, feeble sibilation.

In the 'Magazine of Natural History' for March, 1840, is an interesting account of the Water-Shrew, by Dr. Barnard Clarke:—"Whilst walking," he says, "by the side of the river Gipping, in May, 1838, between Ipswich and the village of Sproughton, my attention was arrested by several water-shrews actively engaged in a dyke that runs parallel to the river. These little creatures were in such rapid motion on the water, that its surface was thrown into a state of quick undulation, though the dyke was at least four feet wide. At times they would be upon the surface, moving at a rapid rate between the blades of the aquatic plants, consisting principally of *Sparganium ramosum* and *simplex*, that grew from the bottom. Then they would dive, and for a while remain beneath; but always, on returning to the top, displaying the greatest rapidity in their movements. Whilst above water, they were constantly repeating their faint though shrill tremulous squeak, which appeared as though expressive of pleasurable sensations. On visiting the spot the following evening, and secreting myself, I had the opportunity of remarking the movements of these little animals on land. I found beneath a slightly hanging bank, and close by the water-side, a long gallery, which, though in a great measure naturally formed, yet had been much laboured at by the shrews to render it a convenient viaduct between one hunting-place and another: the grasses and other plants had been removed, as well as here and there small portions of earth, in order to render this passage, in their movements from end to end, as commodious as possible. I observed the shrews continually passing backwards and forwards through this passage, which enabled them to travel with facility from one part of the ditch to another, and which was principally a little above the water-level, but at intervals there were depressions at which the water passes on to or over its floor. This passage was evidently the common property of many shrews, as several were continually running backwards and forwards along its whole extent, and ultimately taking to the water, swimming up and down the ditch, diving, and performing various evolutions in search of their insect prey. They swim upon or under the surface of the water with equal rapidity, and when beneath, the hair upon their bodies so completely repels the water, that the air entangled in the fur gives to the bodies of these little animals the brilliancy of silver as they pursue their course. On emerging from the water, the coat appears perfectly dry, but this is further insured by the little creature giving itself a sudden shake on arriving at its landing-place. I remarked that in travelling along the above-mentioned gallery, the tremulous shriek is always heard when two shrews happen to pass each other, and the same thing occurs, though not so invariably, in their movements in the water. When a shrew secured an insect, it quitted the water, and ascended a convenient stone, or the projecting root of a tree, a clod of earth, or some similar body, where at leisure it devoured its prize, steadying the insect with its fore-paws, while it nibbled it with the greatest enjoyment. I once traced a pair of shrews into a small hole in a bank by the side of a ditch, where I had been in the habit of observing them; and in order to try and secure them, I carefully removed the earth, when I found that, although the entrance was scarcely larger than just to allow of two shrews passing together, it led into a very capacious vestibule, with galleries leading one into another, and so extensive that there was no possibility of ascertaining their full extent without removing the greater portion of the bank."

The Water-Shrew is three inches three lines in length, exclusive of the tail, which is two inches one line. The colour of all the upper parts is a rich brownish black, the under parts being nearly pure white, with an abrupt line of demarcation between the two colours.

A species termed the Oared Shrew (*Sorex ciliatus*, Sowerby; *Sorex remifer*, Geoffroy) is by most naturalists regarded as distinct, though allied to the Water-Shrew, which it appears to resemble in habits. According to Mr. Yarrell ('Zoological Proceedings,' 1832) the Oared Shrew is distinguishable from the more common Water-Shrew by its greater size and uniform colour, the whole of the upper part of the head, the body, and sides are velvet black; the situation of the ear is marked by a tuft of white hairs, more conspicuous than in the Water-Shrew from the greater contrast of colour. There is a small patch of light brown under the lower jaw; the under-surface of the body is rusty black, and the tail is black with a line of pendent greyish-white hairs along its under surface. Dr. Scougal of Glasgow states that the Oared Shrew is not uncommon in the neighbourhood of that city, and three specimens were recognised by Dr. Hooker as similar in every respect to the Water-Shrew which he had procured in Norfolk. But then, was not this Water-Shrew the S. bicolor or fodiens? In the 'Annals of Natural History' for June, 1841, the Reverend Mr. Jenyns observes, "I have seen so many intermediate specimens between this (the Oared Shrew) and the Water Shrew, that I consider it extremely doubtful whether they be distinct." And he leaves the point as one requiring to be more fully investigated by anatomical comparisons.

Mr. Bell gives the measurement of the Oared Shrew as three inches two lines for the length of the head and body; for the tail, two inches one line.

It would appear that other species of Shrew, besides those we have described, are indigenous in our island. Of these, one, which is common in Ireland, is termed by Mr. Jenyns, Sorex Hibernicus; to this he had previously applied the title of rusticus, having found it in England, while he regarded the Irish Shrew as distinct; but since they have been proved to be the same, he requests "that the name of Hibernicus be hereafter adopted for this species, which, though not confined to Ireland, seems to be the common species in that country, and is much more abundant there than in England, where it gives place in a great measure to the S. tetragonurus. It has been observed in different localities in Ireland, and one specimen, sent me by Mr. Thompson, was stated to have been taken in the county of Antrim, at an elevation of 1200 feet above the level of the sea."—'Ann. and Mag. Zoology,' &c. June 1841, p. 263.

Another species is described by Mr. Jenyns as the Chestnut Shrew (Sorex castaneus), of a bright rufous colour: it is closely allied to the Common Shrew, and may perhaps be only a variety.

The number of foreign shrews is very great, but in habits and manners they resemble those of the British Islands, their destined work being to thin, in conjunction with other insectivora, the innumerable hosts of insects and small "creeping things" which teem upon the surface of the earth. Was it from this cause that the shrew was among the consecrated animals of the ancient Egyptians? For, strange to say, the mummies of two distinct species have been, after the lapse of so many centuries, discovered in a good state of preservation in the crypts of Thebes and Memphis. Of these, one is the Sorex giganteus of Isidore Geoffroy, the "Grande Musaraigne" of Geoffroy, in the 'Catalogue raisonné de M. Passalaqua' (Olivier, 'Voyage en Egypte'). The other is a species of small size, termed by M. Isidore Geoffroy, Sorex religiosus. Of this no fewer than twenty well preserved specimens exist in

the collection of Egyptian antiquities at Paris, belonging to M. Passalaqua. Of this species we have met with no detailed description, nor are we aware that its living prototype is ascertained. From the divine honours paid to it by the superstitious Egyptians, it has received the appellation religiosus. The Shrew, called by the Greeks Mygale, was, as we are informed by ancient authors, especially worshipped in the Athribitic nome (or district) of Egypt, and that it was sacred to, and considered as the mundane representation of Latona. The supposed blindness of this animal is alleged to have been the cause of its dedication to one of the deities of darkness and concealment.

LOCOMOTION OF ANIMALS.—No. II.

In our last article it was stated that muscles are the *active* organs of motion in animals; that they are endowed with great power;—and we pointed out the means by which their power is estimated. If we select four animals of the same order, having similar figures, whose dimensions of one kind are as 1, 2, 3, 4, the weights of the animals and of all their corresponding parts will be as the cubes of these numbers, that is, as 1, 8, 27, 64; but since it is found that the force of a muscle depends on the number of its fibres, this force must increase in the ratio of its transverse section, that is, as the square of one of the dimensions of the animal, or as 1, 4, 9, 16. The contractile force of the muscles in a healthy man, according to Dr. Young, is equivalent to about five hundred pounds for each square inch of the surface presented by their transverse sections. We may then easily understand from the preceding remarks why it is that the most powerful men have their muscles most developed; and why the largest muscles are placed in those parts of the body where they are subjected to the greatest quantity of work. For example, the force of the muscles that close the lower jaw in man is estimated at five hundred pounds; indeed the force of these muscles is well known to be sufficient to crush the soundest teeth when a hard substance is placed between them. Some individuals are capable of holding between the teeth and of supporting by the lower jaw two hundred and forty pounds and upwards. In many of the lower animals, such as the carnivora, the muscles which close the lower jaw are much stronger and more developed than in man, as is exemplified in the ease with which the lion and tiger lacerate their prey.

Some idea of the power of the muscles which unite the limbs to the trunk may be derived from the attempts that have been made to tear the limbs of men from their bodies during life. It is related by Dr. Hodgkin, in his 'Lectures on the Preservation of Health,' that during the reign of Louis XIV. a man was condemned to be torn to pieces by horses; his arms were accordingly tied to one horse, and his legs to another, but the combined efforts of both were insufficient to effect the purpose designed, and the executioner was compelled to *cut* the muscles through before the limbs of the wretched victim could be torn from the body. These illustrations will suffice to establish the great force with which muscles are endowed during life. It is well known that the quantity of labour which the muscles will endure, and the length of time they will continue to act, increase, within certain limits, in proportion to their daily exercise. If the muscles of the arms or legs, or any others, be called suddenly into action for a longer period than that to which they have been accustomed, they soon communicate to the individual a sense of weariness, and evince a disposition to yield to the action opposed to them, and, unless they are allowed some repose, mischief speedily succeeds. But when their action is very gradually increased day after day, it is observed that the bulk of the muscles, and consequently their power, is augmented. For it has been already stated that the force of muscles is directly proportioned to the square of the surfaces which they present on making transverse sections through them: and if we take the estimate of Dr. Young for the basis of a computation of the additional force they acquire by exercise, we shall find that an increase of a quarter of a square inch in a single muscle is equivalent to a gain in strength of $\frac{500}{4}$ or one hundred and twenty-five pounds. Now as a great number of muscles act at the same time in moving the limbs, it follows that they must all become enlarged, in proportion as they contribute to produce that motion. It is therefore practicable, by gradually increasing the exercise of the different muscles of the body daily, and thereby augmenting their bulk, to attain a vast increase of animal strength; and when we consider that health is the result of such exercise, if if it is not carried too far, no stronger argument can be adduced for its adoption. But there is a limit to the amount of exertion which the muscular system will bear: if that limit is passed, the muscles lose their vigour, and lassitude and a flaccid state supervene. Experiment teaches us how long the muscles may be continued in action, and the quantity of force which they are capable of expending during that period. We have before stated that the weight of the body is proportional to the cube, and the power of the muscles to the square, of some one of its dimensions: for instance, in two similar-formed men, whose heights are respectively five and six feet, the muscular power of the former to that of the latter will be as 25 to 36, but their weights will be as 125 to 216, or as 25 to 43 very nearly; the weight, therefore, increases much more rapidly than the muscular power, and consequently a small man is stronger, in proportion to his size, than a larger one. The same law holds good in all animals of the same kind, of which some striking examples will be given in a subsequent number. In persons predisposed to corpulency, and who neglect to use the proper means of checking it, the quantity of fat continues to increase and the muscles to decrease in volume until they exhibit the deplorable phenomenon of an inability to move even their own weight without pain and difficulty: for it is found on dissection that the quantity of muscular fibre is less, and the fibres themselves more flaccid, in fat persons than in others. If then our more opulent neighbours would keep in mind the physical effects of indulgence here described, it might serve as a wholesome check to an inordinate use of the luxuries with which they are surrounded, and induce them, before it is too late, to adopt a regular and sufficient course of muscular exertion. It is true, many are prevented by the nature of their sedentary occupations from taking the kind of exercise which others enjoy in the performance of their ordinary business; but then there are many gymnastic and other modes of calling the muscles into a healthy state of action, which persons engaged in the most sedentary employments may resort to during some portion of the day; so that it is in the power of every one to preserve his health so far as can be effected by exercise alone. Having thus given a general notion of the organs by which the movements of animals are performed, let us now turn our attention to the manner in which those organs act, and the laws by which they are regulated.

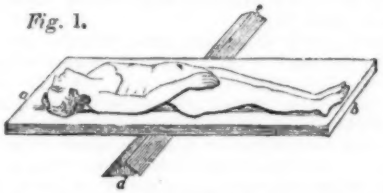
Position of Man in Locomotion.—It is at first sight a matter of no little wonder and speculation how the human figure is maintained in an erect position, supported as it is on such a narrow base as the soles of the feet, and why we do not walk like quadrupeds upon the four extremities, which would afford a large base

of support, bring the centre of gravity nearer the ground, and increase the stability of the whole body. These subjects have engaged the attention of anatomists and zoologists, and have excited no small controversy.

With regard to the power of keeping the body erect, we observe by the numerous trials and falls of children that it can only be acquired by long practice; but still it is purely a mechanical problem. We all know the difficulty of poising a slender cylindrical rod upon one of its ends, and that a very small force directed laterally against it will throw it down.

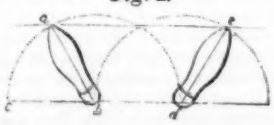
Now in order that any body with its base resting on the earth may remain stationary, it is necessary that a vertical line drawn through its centre of gravity* should also fall within the base. The centre of gravity of the human body may be thus determined:—Having first balanced a board *a b* (Fig. 1) upon the edge of a

Fig. 1.



triangular prism *d e*, let a line be drawn on the board close to the edge of the prism; let the board be again balanced on the prism in any other position, and another line be drawn as before: then a vertical line passing through the intersection of the two lines drawn on the board will pass through its centre of gravity. Now if a person be laid on the board, as represented in the figure, so that the whole mass of the man and board may balance in the same two positions as the board alone did, the centre of gravity of the man will be somewhere in the intersection of the two vertical planes which pass through the lines drawn on the board; and in order to determine the exact position of this centre, let the person stand erect and balance himself on the board, which must be placed in its original position on the prism: then by means of plumb-lines freely suspended on each side over the line drawn on the board, the vertical plane passing through the centre of gravity is found, and consequently the point where the intersection of the other two planes meets the third plane is the centre of gravity, which is generally found to be a point in the junction of the loins with the pelvis, called the *sacro-lumbar articulation;* but its position varies in different individuals in consequence of the different proportions existing between the weight of the trunk and that of the legs. The attitudes and movements of every animal depend on the position of the centre of gravity and base of support. When a man stands erect, a plumb-line passing through his centre of gravity will fall between his feet. It is a subject of mathematical investigation, when the feet are equally advanced and equally inclined (as in Fig. 2), to determine the angle *a b c*, which they must

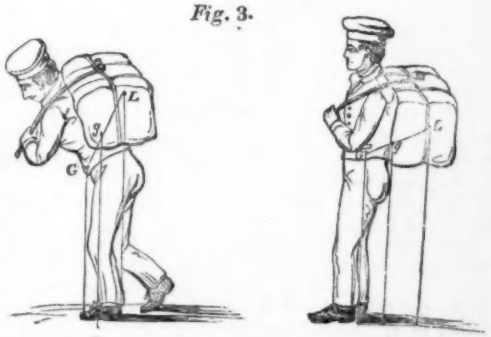
Fig. 2.



* The centre of gravity of any body is that point upon which the body, acted on only by the force of gravity, will balance itself in all positions; consequently, if a line or plane which passes through the centre of gravity be supported, the body will be supported in all positions.

form with the prolongation of the line joining the heels in order to afford the greatest base of support. In general, where the legs are perfectly vertical, it will be found that the line joining the centre of the heels is just equal to the length of the foot, and in this case the required angle will be 60° exactly; as the heels approach each other this angle diminishes, and when they are close together it is rather more than 45°. Opera dancers, beside curving the body, employ their arms to bring the centre of gravity over the base of support, which is often limited to the ball of the great toe of one foot, the weight of the raised leg and foot is also concerned in producing the equilibrium of the body in resting on the other foot. Rope-dancers use a long heavy pole for the same purpose: the pole is grasped by both hands, and carried nearly at right angles to the axis of the rope, as the centre of gravity must be continually brought over the very narrow base which the rope affords, and the rope itself, if slackened, having a motion both lateral and vertical, and being at a considerable height above the ground: the process of rope-dancing requires great muscular activity and precision in the attitudes of the body to secure the performer from falling. The celebrated Madame Saqui, as is well known, lost her life by a fall from a rope. The centre of gravity has always a tendency to oscillate on each side of the rope, and the eye of the performer is fixed on one end of it, by which means he is enabled to keep his body steady, and moreover when his centre of gravity falls on the left side of the rope, a sufficient portion of the pole is shifted to the right side in order to restore the equilibrium. A long rod is then a very good auxiliary for keeping the body steady in positions of difficult equilibrium, such as walking over narrow parapets, or wooden bridges thrown across rivulets without a hand-rail, which may often be met with in country districts. When a porter carries a burden, the attitude

Fig. 3.



of the body must accommodate itself to the position of the common centre of gravity of himself and his load. Thus, in the above figures it will be observed that when the man stands upright, the centre of gravity of the man G falls within the base of support, and if his load L falls without the base, as does likewise *g*, the common centre of gravity of the man and load, the consequence would be that he would fall backwards; but this is prevented, or, which is the same thing, the point *g* is brought within the base by the man bending his body forward. The reverse happens when the load is carried in front; as for instance, by the laundress, whose basket is carried in front, as in Fig. 4. In this case, instead of bending forward, as in the former case, the body is thrown back, in order that the centre of gravity common to the woman and the basket may be brought within the base of support. In these and similar cases the person will be prevented from falling

Fig. 4.

when the line G *g* multiplied by the weight of the man is equal to the line *g* L multiplied by the weight of the load. When a person stoops to place a load, such as a pail of water, on the ground, the hips are thrown backward so as to bring the point *g* within the base of support. Just as the pail reaches the ground the common centre is for a moment, however, beyond the base, and there is great danger of the body falling forwards, which is sometimes prevented by the person instinctively clinging to the edge of the pail. Corpulent persons are observed to walk very erect, in order to throw the centre of gravity immediately over the hip-joints, upon which the body rotates as in Fig. 5.

Fig. 5.

They are also observed to take very short steps, and walk more slowly than others, the cause of which will be discussed hereafter.

The preceding principles are exceedingly important to the sculptor as well as to the painter, because every new position of one part of the body requires a simultaneous adaptation of all the other parts. We shall next proceed to show that man is properly organized to stand and move as a biped, and not as a quadruped.

BUILDING-STONES.—THE NEW HOUSES OF PARLIAMENT.

THE rebuilding of the Houses of Parliament has given rise to an inquiry, more precise than had hitherto been made, into the quality of various kinds of stone as building material; the result of which will probably be valuable in other cases besides that for which it was especially intended.

The circumstances under which the inquiry took place were these:—In the autumn of the year 1838 a commission was appointed by the Crown to inquire into the selection of stone for building the new Houses of Parliament, with a view to the choice of a kind which should possess the largest amount of valuable quality. The commissioners were Sir H. T. De la Beche, the eminent geologist; Mr. Barry, the architect of the new Houses of Parliament; Mr. W. Smith; and Mr. C. H. Smith; and they obtained the assistance of Professor Daniell and Professor Wheatstone, of King's College, in determining the chemical and mechanical qualities of various specimens of stone. During the months of August, September, and October, the commissioners visited numerous quarries in various parts of the country, to inspect the quality of the stone, and to ascertain the available quantity, the price per cubic foot or per ton, the means of conveyance to London, and other particulars of a like kind. They then visited various abbeys, cathedrals, churches, towers, castles, and other public and private buildings, to witness the extent of deterioration which the different kinds of stone seemed to have undergone. As a means of leaving a permanent record of their labours, they caused cubes to be prepared of numerous average specimens of workable stone, and deposited in the Museum of Economic Geology.

In March, 1839, the commissioners presented their report to the office of Woods and Forests. From the following paragraph in their report, it will be seen that *granite* was placed out of the list of stones to which their attention was directed:—"We have not considered it necessary to extend our inquiry to granites, porphyries, and other stones of similar character, on account of the enormous expense of converting them to building purposes in decorated edifices, and from a conviction that an equally durable and in other respects more eligible material could be obtained for the object in view from among the limestones or sandstones of the kingdom. We have nevertheless to acknowledge the receipt of several specimens of granite, among which are some from the estates of the Marquis of Breadalbane, near Oban in the west of Scotland, accompanied by a munificent offer on the part of his lordship, that, should the granite from that locality be considered fit and available for the proposed new Houses of Parliament, he would be willing to make a free gift to the nation of his interest in any quantity that might be required for the purpose."

Before stating the result at which the commissioners arrived, we will give a few details concerning the working of granite for building purposes.

However much granite may have been used for bridges and some other engineering purposes, it has not been much used for buildings, on account of its excessive hardness in working. There are, however, cities in which granite forms a conspicuous material of the buildings. In St. Petersburg, for example, not only the imperial and other palaces, but even ordinary dwelling-houses, have their lower parts lined with slabs of granite. The left bank of the Neva, from the foundry to the Gulf of Cronstadt, and both banks of the canals, are lined by high walls constructed of slabs of granite, as are likewise many bridges over the Neva. The pillars, stairs, balconies, &c. in the palace of Cronstadt are in like manner almost all of the finest granite: those blocks or slabs employed for ornamental purposes are cut and polished by lapidaries; but those intended for less delicate purposes, such as for steps, pillars, &c., are worked by peasants.

Granite was used extensively by the Egyptians and other ancient nations for their temples and palaces; and there are instances of a similar kind sparingly seen in most parts of Europe. The grey granite of Chessi, in France, is the material of which the columns of the ancient temple of Augustus, near Lyons, are made. From the grey granite of Elba have been formed the four columns taken out of the church which contained the tomb of Charlemagne at Aix-la-Chapelle; afterwards transferred to the Musée Napoleon. The antique green granite is the material of a column in the

Villa Pamphili near Rome. Various modifications of red granite have been used for the statue of Peter the Great at St. Petersburg, for the pedestal of the equestrian statue at Florence, and for various purposes of architecture and sculpture. But still the use of granite may be considered as being very limited.

A few months ago Lieutenant Newbold communicated to the Royal Asiatic Society a very interesting account of the Hindu mode of quarrying and polishing granite. The most usual method of quarrying followed in India is to employ the agency of fire. In this process the granite rock is covered with dry bushes of the various *acacias* common on the plains, which are then fired, and kept burning until quite consumed. The intense heat causes a separation or exfoliation of the granite, to the depth perhaps of twenty-four inches, in the centre of the fire, but gradually thinning towards the edges. The piece thus exfoliated is then detached by driving in small iron wedges at the extremities, and is finally raised by a powerful lever. Sometimes the rock proves more refractory than usual, and then it is customary to pour cold water upon it when hot, or to drop on the surface a heavy boulder of greenstone or granite. When blocks are required for statuary or millstones, or for any other purpose where greater thickness than one or two feet is requisite, another process is followed, similar to that employed by the ancient Egyptians in quarrying the granite of Syene. A great number of holes, an inch square, and of different depths according to the size of the block wanted, are bored in the rock nearly close together, forming a connected chain around the piece to be detached. Each hole is then fitted with an iron wedge, and the whole are simultaneously and unremittingly struck with iron hammers, until their united force overcomes the cohesion of the block. The chisels used in piercing the holes are kept cool by pouring water upon them while working. When long and thinner slabs are required for bridges, pavements, lintels, &c., a third process is employed, combining the principles of the two former. The rock is heated by the first mode, and the separation is completed by driving wedges into a chain of holes, as in the second. Lieutenant Newbold stated that he has seen blocks of eighty feet in length separated in this way. He also observed that the Hindus take advantage of the heat of the sun in promoting the separation of the granite slabs. Sometimes they pour cold water into the clefts made by the wedges, which greatly hastens the separation of the block.

The polish given to Indian granite is very brilliant, as may be seen in many of their temples. Two modes of polishing are adopted. When a flat surface is required, the granite is slightly smoothed and flattened by an iron tool; and it is then rubbed with a large and heavy block of granite, hollowed in its under surface, and having its hollow filled up with *lac* and *corundum*. The mixture adheres strongly to the stone, which is tightly fixed between two rods. The extremities of these rods form the handles for two workmen, who draw the stone backwards and forwards over the block to be polished, occasionally throwing water on the surface to prevent the lac from melting. When the piece to be polished is of a more varied form, as a cornice or moulding, a piece of wood, with the corundum mixture, or even a lump of the mixture alone, is used instead of the granite polisher.

It is not to be wondered at that stone which requires such elaborate processes as these for its preparation should be rejected as a building material in general, nor that the commissioners should have left this kind out of the class of those whose fitness they investigated as a building material for the Houses of Parliament. The principal kinds examined were either *sandstone* or *limestone*, each of which presents very numerous varieties and subvarieties. The commissioners visited considerably more than a hundred quarries, in every part of Britain; and examined a large number of public buildings, whose present condition is briefly noted, under the three headings of "sandstone buildings," "limestone buildings," and "magnesian-limestone buildings," according to the kind of stone employed. Every quarry which they visited is entered in a tabulated statement, in which the particulars concerning the stone to be procured from thence are put under nineteen separate headings, in parallel columns. These particulars are, name of quarry—name of place—name of county—nearest post-town—name and address of freeholder—name and address of freeholder's agent—name and address of quarryman—mineral designation of stone—component parts of stone—colour—weight of stone in its ordinary state per cubic foot—entire depth of workable stone—description of the beds—size of blocks that can be procured—prices of block stone at the quarry per cubic foot—description and cost of the carriage to the Pool of London—cost of stone delivered in London per cubic foot—cost of plain-rubbed work as compared with that upon Portland stone, in London, per superficial foot—and lastly, where known or reported to have been employed.

The above details related to the nature and availability of the stone, as ascertained at the quarry. When the specimens reached the hands of Professors Daniell and Wheatstone, they were subjected to various mechanical and chemical tests, to determine their qualities; and the results were given in two tables, included, like the former one, among the Parliamentary Papers for 1839. In the first of these two tables the result of the examination of sixteen specimens of stone is given; five being sandstone, three limestone, four magnesian-limestone, and four oolite. The chemical analysis of all these varieties is first given, that is, the proportionate weights of silica, carbonate of lime, &c. contained in them. Then their specific gravities; next their absorbent powers when saturated under the exhausted receiver of an air-pump; then the disintegration under atmospheric action; and lastly, their cohesive powers. The second table is much more extensive, and contains the results of the examination of a larger variety of specimens, and under a greater number of tests. All the specimens were in the first instance worked into the form of two-inch cubes, in order to facilitate comparison; and the qualities were tabulated in the following order:—Weight in ordinary state, in grains, when freely exposed to the atmosphere—weight when well dried by exposure to heated air for several days—weight when completely saturated, having been immersed in water for several days—weight of water absorbed (being the difference between the last two results)—bulk of water absorbed, a two-inch cube being reckoned as unity—weight of particles disintegrated—cohesive power, as measured, 1st, by the weight requisite to produce fracture of the stone, and 2nd, by the weight needed to crush it completely by a Bramah press.

It will be seen from the above tables, that the commissioners sought to determine the qualities of the various stones in almost every way in which comparison could be introduced. After examining various buildings, the commissioners, in noticing certain favourable qualitities in magnesian-limestone, remark:—"As far as our observations extend, in proportion as the stone employed in magnesian-limestone buildings is crystalline, so does it appear to have resisted the decomposing effects of the atmosphere; a conclusion in accordance with the opinion of Professor Daniell, who has stated to us that, from the result of experiments, he is of opinion that the nearer the magnesian-limestones approach to equivalent proportions of carbonate of lime

and carbonate of magnesia, the more crystalline and better they are in every respect." The commissioners terminated their inquiry by the following recommendation:—"In conclusion, having weighed, to the best of our judgment, the evidence in favour of the various building-stones which have been brought under our consideration, and freely admitting that many sandstones as well as limestones possess very great advantages as building materials, we feel bound to state that for durability, as instanced in Southwell Church, &c., and the results of experiments, as detailed in the accompanying tables; for crystalline character, combined with a close approach to the equivalent proportions of carbonate of lime and carbonate of magnesia; for uniformity of structure; for facility and economy in conversion; and for advantage of colour—the magnesian limestone, or dolomite, of Bolsover Moor and its neighbourhood is in our opinion the most fit and proper material to be employed in the proposed new Houses of Parliament." Of the stone here recommended, about fifty parts in a hundred are carbonate of lime, and forty are carbonate of magnesia, the remaining ten parts being silica, alumina, &c.

Antelope Shooting.—The antelope of this country, I believe to be different from all other known varieties, and it forms one of the most pleasing living ornaments to the western world. They are seen in some places in great numbers, sporting and playing about the hills and dales; and often, in flocks of fifty or a hundred, will follow the boat of the descending voyager, or the travelling caravan, for hours together, keeping off at a safe distance, on the right or left, galloping up and down the hills, snuffing their noses, and stamping their feet, as if they were endeavouring to remind the traveller of the wicked trespass he was making on their own hallowed ground. This little animal seems to be endowed, like many other gentle and sweet-breathing creatures, with an undue share of curiosity, which often leads them to destruction, and the hunter who wishes to entrap them saves himself the trouble of travelling after them. When he has been discovered, he has only to elevate above the tops of the grass his red or yellow handkerchief on the end of his gun-rod, which he sticks in the ground, and to which they are sure to advance, though with great coyness and caution, whilst he lies close, at a little distance, with his rifle in hand; when it is quite an easy matter to make sure of two or three at a shot, which he gets in range of his eye, to be pierced with one bullet. —*Catlin's North American Indians.*

Increasing Consumption of Whale-oil.—It appears worthy of remark, that notwithstanding the large consumption of coal for gas, which has in a great degree superseded the use of oil for street-lighting, the aggregate consumption of whale-oil has very materially increased. This fact is of course referable to the fashion now become very general of burning table-lamps in the place of candles in our dwellings; but it must excite surprise in the mind of every one when first made acquainted with the fact, that during this time the use of candles in dwellings, and especially of wax-candles, has also increased in a greater proportion than the population. It has been suggested, and with much apparent reason, that this increase may be consequent upon the greater brilliancy of the streets since they have been lighted with gas, since we have thus been made dissatisfied with the quantum of light previously thought sufficient within our houses. Certain it is, that our apartments are much more brilliantly lighted now than they were before the introduction of coal-gas, whether that invention be chargeable with the increase or not.—*Porter's Progress of the Nation*, vol. iii. Section v. '*Consumption.*'

New Uses of Iron.—Among the new employments found for iron, must be mentioned ship-building. Iron was first used about the year 1810 for the construction of vessels employed in canal and river navigation. After this, the first similar employment of this material occurred in 1820, when a steam-vessel called the "Aaron Manby" was constructed at the Horsley Iron-works, and made the voyage between the capitals of England and France without unlading any part of her cargo. This vessel is still in good condition, although twenty-two years old, never having required any repairs to her hull. In 1825 a small iron steam-boat was placed on the river Shannon, where she is now employed, in good condition. In 1832, the "Elburkah," an iron steam-vessel, built by Messrs. Macgregor Laird and Co., in Liverpool, made the voyage from that port to the coast of Africa, and twice ascended the river Niger. This successful experiment led to the construction of many other iron steam-vessels. One builder, Mr. John Laird of Birkenhead, near Liverpool, has built forty-five iron vessels, of the aggregate burden of 12,600 tons. The total number launched since 1830 is said to exceed 150. The largest iron vessel yet finished, and in use, is the "Guadaloupe," a steam-frigate of 788 tons, carrying sixty-eight-pounders, and belonging to the Mexican government; but her dimensions are insignificant when compared with those of the "Great Britain," now building, and nearly finished, at Bristol.

The length of this vessel, from her figure-head to the taffrail, is	320 feet
The breadth of beam	51 ,,
The depth of her hold	31 ,,
Her draught of water, when loaded, is calculated to be	16 ,,

and her burden 3500 tons. The engines will have a force equal to that of 1000 horses, and will be used to keep in action, as the means of propulsion, an Archimedean screw. The draught of water will be seen not to exceed that of a first-class West Indiaman. At present this vessel can only be considered as an experiment; and should it fail, an abundance of ridicule will no doubt be cast upon the projectors by men whose genius would hardly have sufficed for the invention of a wherry. A great part of the steam navy of the East India Company consists of iron vessels, twenty-five of which are now in use in India, among which are the "Nemesis," the "Phlegethon," the "Ariadne," and the "Medusa,"—names well known to the British public from the conspicuous part which the vessels have performed in the war with China. The advantages of iron over timber, for naval architecture, are—the absence of "wear and tear" in the hull—no necessity for caulking or coppering—no possibility of injury from dry-rot—greater lightness and increased capacity—and, what is of even far more importance, greater safety. This last point has sometimes been questioned, but not by any one having knowledge on the subject. When a timber-built ship takes the ground with any violent shock, the whole frame-work of the vessel is strained, and in a measure dislocated,—so that by the mere buffeting of the waves she will, in all probability, soon be made a complete wreck; but when an iron-built vessel strikes, however violent the blow, it is only the part that is brought into collision with the rocks that will be injured. The plan of building these ships in water-tight compartments then proves its efficacy; for should the injury amount even to the tearing away of plates, the resulting mischief will only be to fill with water that particular compartment of the vessel to which the injury has occurred, so that the ship will be scarcely less buoyant than before; and experience has shown that damage of this kind is easily repaired. The first cost of iron vessels is somewhat, but not much, less than that of timber-built vessels: their comparative cheapness results from their greater durability: after years of constant employment they are found to be as sound and as clean as when first built. Their weight, upon which depends the displacement of water, is—as a general rule—three-fifths the weight of wooden vessels of the same capacity. The weight of metal used in proportion to the burden of the ship varies, of course, with the size. A sea-going iron steam-vessel will take from nine to twelve cwts. of iron per ton register. Boats intended for river traffic, which do not require an equal degree of strength, of course take a less weight of metal. The building of iron ships is fast becoming an important branch of national industry; it is one in which our mineral riches and our great mechanical skill will secure to us a virtual monopoly.—*Porter's Progress of the Nation*, vol. iii. Section v. '*Consumption.*'

Beautiful Provision of Nature.—The capsules of several species of mesembryanthemum refuse to open except when moistened by the rains, lest, opening in a dry season, they should shed their seeds on an unprepared soil.—*Regions of Vegetation* (South Africa), *by R. B. Hinds, in Capt. Belcher's Voyage round the World.*